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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/835,643	04/17/2001	Kie Y. Ahn	M4065.0383/P383	4830

24998 7590 10/03/2002

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EXAMINER

ANDUJAR, LEONARDO

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 10/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/835,643

Applicant(s)

AHN ET AL.

Examiner

Leonardo Andújar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period of Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 July 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-91 is/are pending in the application.
- 4a) Of the above claim(s) 45-91 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Election/R strictions***

1. Applicant's election without traverse of Group I (claims 1-44) in Paper No. 4 is acknowledged.

***Claim Objections***

2. Claim 41 is objected to because of the following informalities: Claim 41 depends on itself. Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 41 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 41 recites the limitation "said silicide layer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

6. The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application

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being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

7. Claims 1-4 and 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Gardner et al. (US 6,255,698).

8. Regarding claim 1, Gardner (e.g. fig. 1) shows a method of forming a semiconductor device comprising the steps of:

- Forming a signal conductor line 23 over a substrate 10;
- Forming a longitudinal ground conductor plane 27 over the substrate and on a side of the signal conductor line;
- And forming a trench 16 in the substrate in an area between the ground conductor plane and the signal conductor line.

9. Regarding claim 2, Gardner shows an insulating layer 18 deposited on the substrate and a conductive material 22 deposited on the top of the insulating layer.

10. Regarding claim 3, Gardner discloses that the insulating layer is an oxide layer (col. 8/lls. 22-46).

11. Regarding claim 4, Gardner shows a barrier layer 21, which is deposited on the oxide layer before depositing the conductive material (col. 8/lls. 58-59).

12. Regarding claim 8, Gardner shows that the barrier layer comprises TiN (col. 8/lls. 58-59).

***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

15. Claims 6, 7, 9 16-19, 29-32 and 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,255,698).

16. Regarding claim 6, Gardner shows most aspect of the instant invention including an oxide layer having a thickness. Although Gardner does not explicitly disclose that the thickness of the oxide layer is about 200 angstroms to about 300 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the

specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

17. Regarding claim 7, Gardner shows most aspect of the instant invention including a barrier layer having a thickness. Although Gardner does not explicitly disclose that the thickness of the barrier layer is about 50 angstroms to about 100 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

18. Regarding claim 9, Gardner shows most aspect of the instant invention including a conductive material having a thickness. Although Gardner does not explicitly disclose that the thickness of the conductive material is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results

are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

19. Regarding claim 16, Gardner shows most aspect of the instant invention including a ground plane spaced from a signal conductor line. Although Gardner does not explicitly disclose that the ground plane is spaced from the signal conductor line by about 150,000 angstroms to about 200,000 angstroms as claimed by Applicant, differences in spacing distance are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

20. Regarding claim 17, Gardner shows most aspect of the instant invention including signal conductor line having a width. Although Gardner does not explicitly

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disclose that the width of the conductor line is about 250,000 angstroms to about 350,000 angstroms as claimed by Applicant, width differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

21. Regarding claim 18, Gardner shows most aspect of the instant invention including ground conducting planes and the signal conductor line having a thickness. Although Gardner does not explicitly disclose that the thickness of the ground conducting planes and the signal conductor line is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited



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in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

22. Regarding claim 19, Gardner (e.g. fig. 1) shows a method of forming a semiconductor device comprising the steps of:

- Forming a signal conductor line 23 over a silicon substrate 10;
- Forming a longitudinal ground conductor plane 27 over the substrate and on a side of the signal conductor line;
- And forming a trench 16 in the substrate in an area between the ground conductor plane and the signal conductor line.

23. Although Gardner does not explicitly disclose that the depth of the trench is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, depth differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

24. Regarding claim 29, Gardner shows most aspect of the instant invention including a ground plane spaced from a signal conductor line. Although Gardner does

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not explicitly disclose that the ground plane is spaced from the signal conductor line by about 150,000 angstroms to about 200,000 angstroms as claimed by Applicant, differences in spacing distance are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

25. Regarding claim 30, Gardner shows most aspect of the instant invention including signal conductor line having a width. Although Gardner does not explicitly disclose that the width of the conductor line is about 250,000 angstroms to about 350,000 angstroms as claimed by Applicant, width differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited

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in a claim, the applicant must show that the chosen dimensions are critical. In *re* Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

26. Regarding claim 31, Gardner shows most aspect of the instant invention including ground conducting planes and the signal conductor line having a thickness. Although Gardner does not explicitly disclose that the thickness of the ground conducting planes and the signal conductor line is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re* Leshin, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re* Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

27. Regarding claim 32, Gardner (e.g. fig. 1) shows a method of forming a semiconductor device comprising the steps of:

- Forming a signal conductor line 23 over a silicon substrate 10;
- Forming a longitudinal ground conductor plane 27 over the substrate and on a side of the signal conductor line;
- And forming a trench 16 in the substrate in an area between the ground conductor plane and the signal conductor line.

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28. With respect to the shape of the trench, i.e., the radial shaped threch: This limitation, absent any criticality, is only considered to be an obvious modification of the shape of the trench disclosed by Prior Art as the courts have held that a change in shape or configuration, without any criticality, is within the level of skill in the art as the particular shape claimed by applicant is nothing more than one of numerous shapes that a person having ordinary skill in the art will find obvious to provide using routine experimentation based on its suitability for the intended use of the invention. See *In re Dailey*, 149 USPQ 47 (CCPA 1976). Therefore, Gardner does not disclose a round trench having a radius of about 50,000 angstroms to about 100,000 angstroms as claimed by Applicant. Nonetheless, the selected radius range is considered obvious design choices and is not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

29. Regarding claim 42, Gardner shows most aspect of the instant invention including a ground plane spaced from a signal conductor line. Although Gardner does not explicitly disclose that the ground plane is spaced from the signal conductor line by about 150,000 angstroms to about 200,000 angstroms as claimed by Applicant,

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differences in spacing distance are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

30. Regarding claim 43, Gardner shows most aspect of the instant invention including signal conductor line having a width. Although Gardner does not explicitly disclose that the width of the conductor line is about 250,000 angstroms to about 350,000 angstroms as claimed by Applicant, width differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

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31. Regarding claim 44, Gardner shows most aspect of the instant invention including ground conducting planes and the signal conductor line having a thickness. Although Gardner does not explicitly disclose that the thickness of the ground conducting planes and the signal conductor line is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

32. Claims 10, 11, 20, 21, 23-26, 33, 34 and 36-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,255,698) in view Gardner et al. (US 6,255,698).

33. Regarding claim 10, Gardner shows that the conductive material can be any conductive material capable of withstanding high temperature cycles such as polysilicon. Gardner does not explicitly disclose that the conductive layer can be made of copper. Nonetheless, it well known in the art that copper, which is an art recognized equivalent for polysilicon, withstands high temperature. US'698 discloses it is advantageous to use copper instead of polysilicon since copper has a very high electron

storage capacity as compared to polysilicon (col. 8/lis. 47-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use copper as a conductive material in order to increase the electron storage capacity of the device as taught by US'698.

34. Regarding claim 11, Gardner shows that the conductive material can be any conductive material capable of withstanding high temperature cycles such as polysilicon. Gardner does not explicitly disclose that the conductive layer can be made of copper. Nonetheless, it well known in the art that copper, which is an art recognized equivalent for polysilicon, withstands high temperature. US'698 discloses it is advantageous to use copper instead of polysilicon since copper has a very high electron storage capacity as compared to polysilicon (col. 8/lis. 47-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use copper as a conductive material in order to increase the electron storage capacity of the device as taught by US'698. Moreover, Gardner discloses that copper can be deposited by evaporation (col. 13/lis. 42-46).

35. Regarding claim 20, Gardner shows that the method further comprises depositing an oxide layer 18 on the substrate and depositing a conductive material 22 on the top of the oxide layer. Gardner shows that the conductive material can be any conductive material capable of withstanding high temperature cycles such as polysilicon. Gardner does not explicitly disclose that the conductive layer can be made of copper. Nonetheless, it well known in the art that copper, which is an art recognized equivalent for polysilicon, withstands high temperature. US'698 discloses it is

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advantageous to use copper instead of polysilicon since copper has a very high electron storage capacity as compared to polysilicon (col. 8/lis. 47-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use copper as a conductive material in order to increase the electron storage capacity of the device as taught by US'698.

36. Regarding claim 21, Gardner shows that the method further comprises depositing a barrier layer 21 on the oxide layer before depositing the conductive material (col. 8/lis. 58-59).

37. Regarding claim 23, Gardner view of US'698 shows most aspect of the instant invention including an oxide layer having a thickness. Although Gardner view of US'698 does not explicitly disclose that the thickness of the oxide layer is about 200 angstroms to about 300 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

38. Regarding claim 24, Gardner in view of US'698 shows most aspect of the instant invention including a barrier layer having a thickness. Although Gardner in view of



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US'698 does not explicitly disclose that the thickness of the barrier layer is about 50 angstroms to about 100 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

39. Regarding claim 25, Gardner shows that the barrier layer comprises TiN (col. 8/lls. 58-59).

40. Regarding claim 26, Gardner in view of US'698 shows most aspect of the instant invention including a copper layer having a thickness. Although Gardner in view of US'698 does not explicitly disclose that the thickness of the copper layer is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected

results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

41. Regarding claim 33, Gardner shows that the method further comprises depositing an oxide layer 18 on the substrate and depositing a conductive material 22 on the top of the oxide layer. Gardner shows that the conductive material can be any conductive material capable of withstanding high temperature cycles such as polysilicon. Gardner does not explicitly disclose that the conductive layer can be made of copper. Nonetheless, it is well known in the art that copper, which is an art recognized equivalent for polysilicon, withstands high temperature. US'698 discloses it is advantageous to use copper instead of polysilicon since copper has a very high electron storage capacity as compared to polysilicon (col. 8/lis. 47-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use copper as a conductive material in order to increase the electron storage capacity of the device as taught by US'698.

42. Regarding claim 34, Gardner shows that the method further comprises a depositing a barrier layer 21 on the oxide layer before depositing the conductive material (col. 8/lis. 58-59).

43. Regarding claim 36, Gardner view of US'698 shows most aspect of the instant invention including an oxide layer having a thickness. Although Gardner view of US'698 does not explicitly disclose that the thickness of the oxide layer is about 200 angstroms

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to about 300 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

44. Regarding claim 37, Gardner in view of US'698 shows most aspect of the instant invention including a barrier layer having a thickness. Although Gardner in view of US'698 does not explicitly disclose that the thickness of the barrier layer is about 50 angstroms to about 100 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

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45. Regarding claim 38, Gardner shows that the barrier layer comprises TiN (col. 8/lls. 58-59).

46. Regarding claim 39, Gardner in view of US'698 shows most aspect of the instant invention including a copper layer having a thickness. Although Gardner in view of US'698 does not explicitly disclose that the thickness of the copper layer is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, thickness differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

47. Claims 5, 12, 13, 22, 27, 28, 35, 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,255,698) in view Gardner et al. (US 6,255,698) further in view of Filipiak (US 5, 447, 887).

48. Regarding claim 5, Gardner shows that the conductive material can be any conductive material capable of withstanding high temperature cycles such as polysilicon. Gardner does not explicitly disclose that the conductive layer can be made of copper. Nonetheless, it well known in the art that copper, which is an art recognized

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equivalent for polysilicon, withstands high temperature. US'698 discloses it is advantageous to use copper instead of polysilicon since copper has a very high electron storage capacity as compared to polysilicon (col. 8/lls. 47-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use copper as a conductive material in order to increase the electron storage capacity of the device as taught by US'698. Moreover, Gardner shows spacers 55 made of silicon nitride (col. 11/lls. 41-44). Gardner in view of US'698 does not show a silicide layer on the sidewall of the metal layer. Filipiak teaches that the adhesion of silicon nitride to a copper surface is improved by the addition of an intervening copper silicide layer (col. 2/lls. 17-37). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a silicide layer on the side wall of the metal layer disclosed by Gardner in view of US'698 in order to improve the adhesion of the silicon nitride spacers to the copper layer surface as taught by Filipiak.

49. Regarding claim 12, Filipiak discloses that silane is used to form the silicide layer (col. 2/lls. 17-37).

50. Regarding claim 13, Filipiak discloses that the metal layer is exposed to silane during the silicidation process. The silicidation temperature range is from 200 to 450 °C (table I).

51. Regarding claim 22, Gardner in view of US'698 shows most aspect of the instant invention including copper layer. Also, Gardner shows spacers 55 made of silicon nitride (col. 11/lls. 41-44). Gardner in view of US'698 does not show a silicide layer on the sidewall of the metal layer. Filipiak teaches that the adhesion of silicon nitride to a

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copper surface is improved by the addition of an intervening copper silicide layer (col. 2/lls. 17-37). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a silicide layer on the side wall of the metal layer disclosed by Gardner in view of US'698 in order to improve the adhesion of the silicon nitride spacers to the copper layer surface as taught by Filipiak.

52. Regarding claim 27, Filipiak discloses that silane is used to form the silicide layer (col. 2/lls. 17-37).

53. Regarding claim 28, Filipiak discloses that the metal layer is exposed to silane during the silicidation process. The silicidation temperature range is from 200 to 450 °C (table I).

54. Regarding claim 35, Gardner in view of US'698 shows most aspect of the instant invention including copper layer. Also, Gardner shows spacers 55 made of silicon nitride (col. 11/lls. 41-44). Gardner in view of US'698 does not show a silicide layer on the sidewall of the copper layer. Filipiak teaches that the adhesion of silicon nitride to a copper surface is improved by the addition of an intervening copper silicide layer (col. 2/lls. 17-37). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a silicide layer on the side wall of the metal layer disclosed by Gardner in view of US'698 in order to improve the adhesion of the silicon nitride spacers to the copper layer surface as taught by Filipiak.

55. Regarding claim 40, Filipiak discloses that silane is used to form the silicide layer (col. 2/lls. 17-37).

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56. Regarding claim 41 (as understood), Filipiak discloses that the metal layer is exposed to silane during the silicidation process. The silicidation temperature range is from 200 to 450 °C (table I).

57. Claim 14 and 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 6,255,698) in view of Hsue et al. (US 5,846, 625)

58. Regarding claim 14, Gardner shows most aspect of the instant invention including a trench. Gardner fails to specify the method used for making the trench (col. 8/lls. 18-21). Hsue shows a semiconductor device having a trench (e.g. fig. 8). Hsue discloses that etching is a common method used for making trenches (col. 2/lls. 37-44). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the trench disclosed by Gardner using an etching process since etching is a common method used in the art for making a trench as taught by Hsue. Although Gardner does not explicitly disclose that the depth of the trench is about 100,000 angstroms to about 200,000 angstroms as claimed by Applicant, depth differences are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. Moreover, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the

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chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

59. Regarding claim 15, Gardner shows most aspect of the instant invention including a trench. Gardner fails to specify the method used for making the trench (col. 8/lls. 18-21). Hsue shows a semiconductor device having a trench (e.g. fig. 8). Hsue discloses that etching is a common method used for making trenches (col. 2/lls. 37-44). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the trench disclosed by Gardner using an etching process since etching is a common method used in the art for making a trench as taught by Hsue. Gardner in view of Hsue does not explicitly teach the preferable etching rate. Nonetheless, the etching rate is a process parameter subject to optimization. Generally high etch rates are desirable as they allow higher production throughputs. The specific etching rate claimed by applicant, i.e., 2.2  $\mu\text{m}/\text{min}$ , absent any criticality, is only considered to be the "optimum" etching rate of the etching process suggested by the Prior Art that a person having ordinary skill in the art would have been able to determine using routine experimentation based, among other things, on the desired accuracy, manufacturing costs, etc. (see In re Boesch, 205 USPQ 215 (CCPA 1980)).

### ***Conclusion***

60. Papers related to this application may be submitted directly to Art Unit 2826 by facsimile transmission. Papers should be faxed to Art Unit 2826 via the Art Unit 2826 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November



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1989). The Art Unit 2826 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2826 Fax Center is to be used only for papers related to Art Unit 2826 applications.

61. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Leonardo Andújar** at **(703) 308-0080** and between the hours of 9:00 AM to 7:00 PM (Eastern Standard Time) Monday through Thursday or by e-mail via [Leonardo.Andujar@uspto.gov](mailto:Leonardo.Andujar@uspto.gov). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn, can be reached on (703) 308-6601.

62. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 305-3900**.

**Leonardo Andújar**

Patent Examiner Art Unit 2826

LA

9/25/02

**NATHAN J. FLYNN**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**